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Cornell University

PROGRESS REPORT

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Evaluation of Skylab Imagery as an Information Service for Investigating
Land Use and Natural Resources (Skylab), NASA Contract NAS 9-13364

This report covers the period from May 1-31, 1974. The resolution and interpretation characteristics of the SL3, S190A films and filter combinations were all compared to the high resolution black and white film (S190B). This was to determine which film/filter combination would provide the most useful data. All comparisons, except the 2 color films, were made with films photographically enlarged to a scale of approximately 1:250,000 and then projected to a scale of 1:62,500 for interpretation. The area studied was of Tompkins County, New York and base maps were used to determine the scale of 62,500.

The black and white high resolution film (S190B) has both excellent resolution and contrast. It maintains good image fidelity up to a scale of 1:24,000. Conventional airphoto interpretation techniques (texture, tone, configuration, etc.) can easily be used to identify a wide range of land uses. All roads and runways 30 feet or wider can be determined regardless of surface and provided they are not covered by dense forest canopy. Most buildings larger than 80 feet by 40 feet in good contrast situations can be identified as point data. Streams and canals 80 feet and wider are also identifiable.

Most water boundaries are not in good contrast to the background and this makes mapping very difficult for small water bodies. Although resolution is excellent, farm ponds (200 feet - 500 feet diameter) could not consistently be identified due to low contrast of water with the surrounding land use.

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Interpretational contrast in the S190A films was most evident when using composites made up of the spectral bands in the 3 photographic primary colors of cyan, magenta and yellow. Many combinations were attempted using the spectral bands 500-600 nanometers, 600-700 nanometers in both positive and negative films. Each of these 6 films were printed in cyan, magenta and yellow diazo film. The color composite which proved to have the most enhancement of the spectral information included: a positive yellow film (800-900 nanometers), a negative cyan film (600-700 nanometers) and a negative magenta film (500-600 nanometers).

The composite has an area resolution of about 4 hectares in high contrast situations. Land use spectral break outs are interpreted more rapidly and accurately from such a color composite than from each individual band, even though the resolution for each individual visible band is better. No point data is available although most major roadways and small lakes (4 hectares) can be identified.

The S190A black and white film in both the 500-600 and 600-700 nanometer spectral bands have a higher resolution than the color composite. However, the color contrast of the composite is more interpretable for all land uses, especially for water boundaries. This is true of the S190A color aerial film which has less resolution than the spectral bands but better contrast, it also is not as good for interpretation of spectral break outs as the color composite.

The S190A color IR film is only fair in contrast and poor in resolution, this is probably due to the IR film characteristics. The S190A IR black and white film in the 800-900 nanometer band is both poor in contrast and resolution. This grainy structure also makes enlargements of very low

quality, which is an unfortunate situation because spectrally it is known that many distinctions can be made in the IR band. ERTS research showed this band to be one of the primary components of a good spectral color composite.

Another duplicate set of images was received during early June covering the Central New York area. Our original shipment had appeared underexposed. The corrected images in both black and white and color appear to have marked improvement in both contrast and resolution. Grain on the IR bands also appears to be somewhat reduced. No enlargements of this data have as yet been made.

Preliminary interpretations of the Long Island and Hudson test sites were completed and the areas field checked to determine interpretation accuracy. The field check of Long Island indicated that urban areas, plowed agriculture, and other disturbed soil areas were being confused in the interpretation because of the similarity in spectral response. The Residential category was broken into 3 levels: light, medium and heavy. Forest was broken into mixed, coniferous and deciduous. Forest and residential categories were generally quite accurate although some difficulty occurred in distinguishing light residential from forest in heavily wooded areas. The breakout of forest into deciduous, and coniferous was not very accurate. Golf courses seemed to have 3 different spectral responses. Wetlands were not picked up on the Skylab interpretation except in one location where they covered 20-25 hectares.

Four ten Kilometer square cells on Long Island have been checked more intensively, comparing the Skylab spectral data and the color terrain data,

with the ground truth information to determine ways of improving the interpretation accuracy. Spatial, locational and textural characteristics can be used to separate urban and plowed agricultural areas in most cases. Wetlands seem to be lost in the surrounding land uses -- the poor resolution in the infrared band causes part of this problem.

ERTS imagery of September 16, 1973 was processed and interpreted for comparison with the Skylab data. Data take-off has been completed for one 10Km cell of Skylab and ERTS and the data compared to LUNR.

Data from this one cell indicate that the agreement between LUNR and Skylab is much closer (in 90 percentile for all but Wetlands) than the agreement with ERTS and LUNR. Some urban and residential can be identified from Skylab because of textural characteristics that do not show up in ERTS. Both these categories are underestimated in ERTS. Wetlands were not interpreted from either Skylab or ERTS. ERTS and Skylab were not compared directly numerically because there were 664 hectares of clouds in the ERTS imagery that prevent direct comparison. Analysis of the Hudson test site is not yet complete.

A series of slide presentations are being prepared for use in talking to planners and resource managers in order to introduce to these people a brief overview of what the satellite data means and how it might be incorporated in different planning operations. Contact with planning groups is expected to begin on a limited basis during June.

Dr. Ernest Hardy and Mr. James Skaley will travel to Houston July 15-19 to attend the Skylab PI Conference.

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